

## CLAIMS

1      1.(**withdrawn**)      A composition comprising a modified nucleotide including a molecular and/or  
2      atomic tag, where the nucleotide alters base incorporation fidelity in a nucleotide polymerizing agent  
3      relative to a base incorporation fidelity of the agent in the absence of the modified nucleotide.

1      2.(**withdrawn**)      The composition of claim 1, wherein the modified nucleotide comprises a  $\beta$   
2      and/or  $\gamma$  phosphate modified nucleotide.

1      3.(**withdrawn**)      The composition of claim 1, wherein the modified nucleotide comprises a  $\beta$   
2      phosphate modified nucleotide.

1      4.(**withdrawn**)      The composition of claim 1, wherein the modified nucleotide comprises a  $\gamma$   
2      phosphate modified nucleotide.

1      5.(**withdrawn**)      The composition of claim 4, wherein the tag comprises a molecule.

1      6.(**withdrawn**)      The composition of claim 5, wherein the tag is ANS.

1      7.(**currently amended**)      A method for using modified nucleotides to alter base incorporation  
2      fidelity comprising the step of adding a modified nucleotide including a molecular ~~and/or atomic~~ tag  
3      to a nucleotide polymerization medium comprising a nucleotide polymerizing agent, a primer and  
4      a template, where the modified nucleotide alters base incorporation fidelity of ~~a~~ the nucleotide  
5      polymerizing agent relative to a base incorporation fidelity of the nucleotide polymerizing agent in  
6      the absence of the modified nucleotide.

1      8.(**original**)      The method of claim 7, wherein the modified nucleotide comprises a  $\beta$  and/or  $\gamma$   
2      phosphate modified nucleotide.

1      9.(**original**)      The method of claim 7, wherein the modified nucleotide comprises a  $\beta$  phosphate  
2      modified nucleotide.

1 10.(original) The method of claim 7, wherein the modified nucleotide comprises a  $\gamma$  phosphate  
2 modified nucleotide.

1 11.(canceled) The method of claim 10, wherein the tag comprises a molecular tag.

1 12.(currently amended) The method of claim ~~11~~10, wherein the tag comprises  
2 aminonaphthalene-1-sulfonate (ANS).

1 13.(currently amended) A method for using modified nucleotides to alter base incorporation  
2 fidelity comprising the step of adding a modified nucleotide including a molecular ~~and/or atomic~~ tag  
3 to an assay for extending a nucleotide sequence, where the modified nucleotide alters base  
4 incorporation fidelity of a nucleotide polymerizing agent relative to a base incorporation fidelity of  
5 the polymerizing agent in the absence of the modified nucleotide, and the assay is selected from the  
6 group consisting of genotyping for *in vitro* reproductive methods (human and other organisms);  
7 single nucleotide polymorphism (SNP) detection; DNA sequencing; RNA sequencing; single  
8 nucleotide extension assays; amplified DNA product assays; rolling circle product assays; PCR  
9 product assays; allele-specific primer extension assays; single-molecule arrays (DNA, RNA, protein)  
10 assays; and drug toxicity evaluation assays.

1 14.(withdrawn) A method for making blunt-ended fragments comprising the steps of  
2 amplifying a DNA fragment in the presence of a nucleotide including a molecular and/or atomic tag  
3 on a  $\gamma$  phosphate group and/or a base moiety, where the tag alters fidelity of base incorporation and  
4 decreases or eliminates non-templated addition of a base to the 3' end of the DNA fragment being  
5 amplified.

1 15.(currently amended) A kit for performing a nucleotide polymerizing reaction comprising  
2 ~~polymerizing reagents and~~ using at least one modified nucleotide including ~~an atomic and/or a~~  
3 molecular tag in the presence of a polymerizing agent, a primer and a template, where the modified  
4 nucleotide alters polymerizing agent extension fidelity for the at least one modified nucleotide  
5 compared to the polymerizing agent extension fidelity in the unmodified nucleotide corresponding  
6 to the at least one modified nucleotide.

1 16.(**withdrawn**) A method of inhibiting or preventing pyrophosphorolysis during synthesis of  
2 a nucleic acid molecule, said method comprising  
3 (a) combining a primer with a nucleic acid template under conditions sufficient to form a hybridized  
4 product; and  
5 (b) incubating the hybridized product with a polymerase in the presence or absence of an enzyme  
6 selected from the group consisting of a pentosyltransferase, a phosphotransferase with alcohol group  
7 as acceptor, a nucleotidyltransferase, and a carboxy-lyase, under conditions sufficient to form a  
8 second nucleic acid molecule complementary to all or a portion of the nucleic acid template,  
9 where a tagged nucleotide comprises an atomic and/or molecular tag or moiety attached to  
10 and/or associated with a  $\beta$  and/or  $\gamma$ -phosphate and/or a base moiety of the nucleotide is added at  
11 either or both steps to inhibit or prevent pyrophosphorolysis during synthesis of a nucleic acid  
12 molecule.

1 17.(**withdrawn**) A composition comprising a nucleotide including a molecular and/or atomic  
2 tag on a phosphate group adapted to alter the fidelity of viral replication.

1 18.(**withdrawn**) The composition of claim 17, wherein the virus is HIV.

1 19.(**withdrawn**) A method for increasing the fidelity of replication comprising administering  
2 an therapeutically effective amount of a nucleotide including a molecular and/or atomic tag on a  $\gamma$   
3 phosphate group to an animal including a human, where the nucleotide is designed to increase base  
4 incorporation fidelity during replication.

1 20.(**withdrawn**) The method of claim 19, wherein the replication is caused by an HIV virus.

1 21.(**currently amended**) The method of claim 7, wherein the tag ~~comprises a molecular tag~~ is  
2 covalently bonded to the modified nucleotide through a linker.

1 22.(**currently amended**) The method of claim 7, wherein the tag ~~comprises a molecular tag~~ is  
2 covalently bonded to the modified nucleotide.

23.(currently amended) The method of claim ~~11~~10, wherein the molecular tag comprises a fluorophore selected from the group consisting of 4-acetamido-4'-isothiocyanatostilbene-2,2'-disulfonic acid; acridine and derivatives: acridine, acridine isothiocyanate; 5- (2'-aminoethyl) aminonaphthalene-1-sulfonic acid (EDANS); 4-amino-3-vinylsulfonyl phenyl] naphthalimide-3,5 disulfonate; - (4-anilino-1-naphthyl) maleimide; anthranilamide; BODIPY; Brilliant Yellow; coumarin and derivatives: coumarin, 7-amino-4-methylcoumarin (AMC, Coumarin 120), 7-amino-4-trifluoromethylcoumarin (Coumaran 151); cyanine dyes; cyanosine; 4', 6-diaminidino-2-phenylindole (DAPI); 5', 5''-dibromopyrogallol-sulfonaphthalein (Bromopyrogallol Red); 7-diethylamino-3-(4'-isothiocyanatophenyl)-4-methylcoumarin; diethylenetriamine pentaacetate; 4,4'-diisothiocyanatodihydro-stilbene-2,2'-disulfonic acid; 4,4' diisothiocyanatostilbene-2,2'-disulfonic acid; 5-dimethylamino naphthalene-1-sulfonyl chloride (DNS, dansylchloride); 4-dimethylaminophenylazophenyl-4'-isothiocyanate (DABITC); eosin and derivatives: eosin, eosin isothiocyanate, erythrosin and derivatives: erythrosin B, erythrosin, isothiocyanate; ethidium; fluorescein and derivatives: 5-carboxyfluorescein (FAM), 5- (4, 6-dichlorotriazin-2-yl) aminofluorescein (DTAF), 2', 7'-dimethoxy-4'-5'-dichloro-6-carboxyfluorescein (JOE), fluorescein, fluorescein isothiocyanate, QFITC, (XRITC); fluorescamine; IR144; IR1446; Malachite Green isothiocyanate; 4-methylumbelliferoneortho cresolphthalein; nitrotyrosine; pararosaniline; Phenol Red; B-phycoerythrin; o-phthalaldehyde; pyrene and derivatives: pyrene, pyrene butyrate, succinimidyl 1-pyrene; butyrate quantum dots; Reactive Red 4 (Cibacron<sup>TM</sup> Brilliant Red 3B-A) rhodamine and derivatives: 6-carboxy-X-rhodamine (ROX), 6-carboxyrhodamine (R6G), lissamine rhodamine B sulfonyl chloride rhodamine (Rhod), rhodamine B, rhodamine 123, rhodamine X isothiocyanate, sulforhodamine B, sulforhodamine 101, sulfonyl chloride derivative of sulforhodamine 101 (Texas Red); N, N, N', N'-tetramethyl-6-carboxyrhodamine (TAMRA); tetramethyl rhodamine; tetramethyl rhodamine isothiocyanate (TRITC); riboflavin; rosolic acid; terbium chelate derivatives; Cy 3; Cy 5; Cy 5.5; Cy 7; IRD 700; IRD 800; La Jolla Blue; phthalocyanine; and naphthalocyanine.

24.(currently amended) The method of claim ~~11~~10, wherein the molecular tag is selected from the group consisting of alkyl groups having between 1 and 30 carbon atoms, aryl groups having between about 6 and about 40 carbon atoms, or alkaryl and aralkyl groups having between about 7

and about 40 carbon atoms, or mixture or combinations thereof, where the carbon atoms are replaced by one or more hetero atoms in the structure provided the structure represents a stable molecular system, where the hetero atoms selected from the group consisting of P, S, Si, N, and O.

25.(currently amended) The method of claim 10, wherein the molecular tag is selected from the group consisting of 4-aminophenol, 6-aminonaphthol, 4-nitrophenol, 6-nitronaphthol, 4-methylphenol, 6-chloronaphthol, 4-methoxyphenol, 6-bromonaphthol, 4-chlorophenol, 6-iodonaphthol, 4-bromophenol, 4, 4'-dihydroxybiphenyl, 4-iodophenol, 8-hydroxyquinoline, 4-nitronaphthol, 3-hydroxypyridine, 4-aminonaphthol, umbelliferone, 4-methylnaphthol, resorufin, 4-methoxynaphthol, 8-hydroxypyrene, 4-chloronaphthol, 9-hydroxyanthracene, 4-bromonaphthol, 6-nitro-9-hydroxyanthracene, 4-iodonaphthol, 3-hydroxyflavone, 6-methylnaphthol, fluorescein, 6-methoxynaphthol, 3-hydroxybenzoflavone, 1-hydroxy-2-propyne, 1-hydroxy-4-pentyne, 1-hydroxy-3-butyne, 1-hydroxy-5-hexyne, Methanol, Ethanol, Propanol, Isopropanol, Butanol, Tert-butanol, Hexanol, Cyclohexanol, Heptanol, Octanol, Decanol, Undecanol, Dodecanol, 1-acetoxymethanol (CH<sub>3</sub>OCCH<sub>2</sub>-O-NTP), 2-acetoxyethanol, 3-acetoxypopropanol, 4-acetoxybutanol, 5-acetoxypentanol, 6-acetoxyhexanol, 2-nitroethanol, 3-nitropropanol, 4-nitrobutanol, 5-nitropentanol, 5-nitrohexanol, 1-hydroxy-3-propene, 1-hydroxy-2-cyclohexene, 1-hydroxy-4-butene, 1-hydroxy-3-propaldehyde, 1-hydroxy-5-pentene, 1-hydroxy-4-butanaldehyde, 1-hydroxy-6-hexene, 1-hydroxy-3-Butanone, Phenol, 4-methyl-3-hydroxypyridine, 4-Carboxyphenol, 5-methoxy-3-hydroxypyridine, 4-Acetoxymethylphenol, 5-nitro-3-hydroxypyridine, 4-nitrophenol, 5-acetoxymethyl-3-hydroxypyridine, 4-methylphenol, 6-methyl-8-hydroxyquinoline, 4-methoxyphenol 6-methoxy-8-hydroxyquinoline, 4-ethylphenol, 4-methyl-8-hydroxyquinoline, 4-butylphenol, 6-nitro-8-hydroxyquinoline, naphthol, 4-acetoxymethyl-8-hydroxyquinoline, 4 or 6 or 8 methylnaphthol pyrene, 4 or 6 or 8 methoxynaphthol, 6-methyl-8-hydroxypyrene, 4 or 6 or 8 nitronaphthol, 6-ethyl-8-hydroxypyrene, 4 or 6 or 8 ethylnaphthol, 6-nitro-8-hydroxypyrene, 4 or 6 or 8 butylnaphthol 6-(carboxysuccinimidylester) fluorescein, 4 or 6 or 8 acetoxymethylnaphthol, 6-carboxymethyl-2, 7-dichlorofluorescein, Methanol Cyclohexanol, 2-carboxy ethanol, 3-carboxypropanol, 4-carboxybutanol, 2-hydroxyethanol, 3-hydroxypropanol, 4-hydroxybutanol, 2-aminoethanol, 2-nitroethanol, 3-aminopropanol, 3-nitropropanol, 4-aminobutanol, and 4-nitrobutanol.

26.(previously presented) The method of claim 10, wherein the modified nucleotide is selected from the group consisting of Adenosine-5'- ( $\gamma$ -ANS) triphosphate, Guanosine-5'- ( $\gamma$ -ANS) triphosphate, Cytosine-5'- ( $\gamma$ -ANS) triphosphate, Thymidine-5'- ( $\gamma$ -ANS) triphosphate, Adenosine-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-iodonaphthyl), Guanosine-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, triphosphate Adenosine-5'- ( $\gamma$ -6-methylnaphthyl) triphosphate, Cytosine-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, Thymidine-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -6-methoxynaphthyl) triphosphate, Uracil-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, 3'-azido-3'-deoxythymidine-5'-( $\gamma$ -4-nitrophenyl)triphosphate, Adenosine-5'- ( $\gamma$ -6-aminonaphthyl) triphosphate, 3'-azido-2', 3'-dideoxythymidine-5'- ( $\gamma$ -4- nitrophenyl)triphosphate, Adenosine-5'- ( $\gamma$ -6-nitronaphthyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- ( $\gamma$ -4-nitrophenyl)triphosphate, Adenosine-5'- ( $\gamma$ -6-chloronaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-aminophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -6-bromonaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-methylphenyl) triphosphate, Adenosine-5'- ( $\gamma$ -6-iodonaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-methoxyphenyl) triphosphate, Adenosine-5'-( $\gamma$ -4'-hydroxybiphenyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-chlorophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -8-quinolyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-bromophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -3-pyridyl) triphosphate, Adenosine-5'- ( $\gamma$ -umbelliferone), Adenosine-5'- ( $\gamma$ -4-iodophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-nitronaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -resorufin) triphosphate, Adenosine-5'- ( $\gamma$ -pyrene) triphosphate, Adenosine-5'- ( $\gamma$ -4-aminonaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -anthracene) triphosphate, Adenosine-5'-( $\gamma$ -6-nitroanthracene) triphosphate, Adenosine-5'- ( $\gamma$ -4-methylnaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -flavonyl) triphosphate, Adenosine-5'-( $\gamma$ -4-methoxynaphthyl) triphosphate, Adenosine-5'-( $\gamma$ -fluorescein) triphosphate, Adenosine-5'- ( $\gamma$ -benzoflavone) triphosphate, Adenosine-5'- ( $\gamma$ -4-chloronaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ - (4-nitrophenyl)-  $\gamma'$ - (4-aminophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-bromonaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ - (4-nitrophenyl)-  $\gamma'$ - (4-nitronaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -methyl) triphosphate, Adenosine-5'- ( $\gamma$ -acetoxypentyl)triphosphate, Guanosine-5'- ( $\gamma$ -methyl) triphosphate, Cytosine-5'- ( $\gamma$ -methyl) triphosphate, Adenosine-5'-( $\gamma$ -acetoxymethyl)triphosphate (CH<sub>3</sub>OCCH<sub>2</sub>-O-NTP), Thymidine-5'- ( $\gamma$ -methyl) triphosphate, Uracil-5'- ( $\gamma$ -methyl) triphosphate, Adenosine-5'-( $\gamma$ -acetoxylethyl) triphosphate, 3'-azido-3'-deoxythymidine-5-( $\gamma$ -methyl)triphosphate, Adenosine-5'- ( $\gamma$ -acetoxypentyl)triphosphate, 3'-azido-2', 3'-dideoxythymidine-5'- ( $\gamma$ -methyl) triphosphate, Adenosine-5'- ( $\gamma$ , acetoxypentyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- ( $\gamma$ -methyl)

triphosphate, Adenosine-5'- (γ- acetoxyhexyl) triphosphate, Adenosine-5'- (γ-ethyl) triphosphate, Adenosine-5'- (γ-2-nitroethyl) triphosphate, Adenosine-5'- (γ-propyl) triphosphate, Adenosine-5'- (γ-4-butyl) triphosphate, Adenosine-5'- (γ-3-nitropropyl) triphosphate, Adenosine-5'- (γ-hexyl) triphosphate, Adenosine-5'- (γ-octyl) triphosphate, Adenosine-5'- (γ-4-nitrobutyl)triphosphate, Adenosine-5'- (γ-decyl) triphosphate, Adenosine-5'- (γ-dodecyl) triphosphate, Adenosine-5'- (γ-5-nitropentyl)triphosphate, Adenosine-5'- (γ-isopropyl) triphosphate, Adenosine-5'- (γ-tert-butyl) triphosphate, Adenosine-5'- (γ-methyl)- (γ'-ethyl) triphosphate, Adenosine-5'- (γ-cyclohexyl) triphosphate, Adenosine-5'- (γ-methyl)- (γ'-propyl) triphosphate, Adenosine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-3-butenyl) triphosphate, Guanosine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-4-pentenyl) triphosphate, Cytosine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-5-hexenyl) triphosphate, Thymidine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-cyclohexenyl) triphosphate, Uracil-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-3-propanaldehyde) triphosphate, 3'-azido-3'-deoxythymidine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-4-butanaldehyde) triphosphate, 3'-azido-2',3'-dideoxythymidine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-3-butanone) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-2-propynyl) triphosphate, 3'-azido-2', 3'-dideoxythymidine-5'- (γ-2-propynyl) triphosphate, Guanosine-5'- (γ-2-propynyl) triphosphate, Cytosine-5'- (γ-2-propynyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- (γ-2-propynyl) triphosphate Thymidine 5'- (γ-2-propynyl) triphosphate, Uracil-5'- (γ-2-propynyl) triphosphate, Adenosine-5'- (γ-3-butyryl) triphosphate, 3'-azido-3'-deoxythymidine-5'- (γ-2-propynyl) triphosphate, Adenosine-5'- (γ-4-pentyryl) triphosphate, Adenosine-5'- (γ-5-pentyryl) triphosphate, Adenosine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 acetoxymethyl naphthyl) triphosphate, Guanosine-5'- (γ-4-phenyl) triphosphate, Cytosine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (4-methylpyridyl) triphosphate, Thymidine-5'- (γ-4-phenyl) triphosphate, Uracil-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (5-methoxypyridyl) triphosphate, 3'-azido-3'-deoxythymidine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (5-nitropyridyl) triphosphate, 3'-azido-2',3'-dideoxythymidine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (5-acetoxymethylpyridyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (6-methyl-1-quinolyl) triphosphate, Adenosine-5'- (γ-4-carboxyphenyl) triphosphate, Adenosine-5'- (γ- (6-methoxy-1-quinolyl) triphosphate, Adenosine-5'- (γ- (4-acetoxymethyl) phenyl) triphosphate, Adenosine-5'- (γ- (4-methyl-1-quinolyl) triphosphate,

Adenosine-5'- (γ-4-nitrophenyl) triphosphate, Adenosine-5'- (γ-4-methylphenyl)triphosphate, Adenosine-5'- (γ- (6-nitro-1-quinolyl) triphosphate, Adenosine-5'- (γ-4-methoxyphenyl) triphosphate, Adenosine-5'- (γ- (4-acetoxymethylpyrenyl) triphosphate, Adenosine-5'- (γ-4-ethylphenyl) triphosphate, Adenosine-5'- (γ- (6-methylpyrenyl) triphosphate, Adenosine-5'- (γ-4-butylphenyl) triphosphate, Adenosine 5'-(γ-naphthyl) triphosphate, Adenosine-5'- (γ- (6-ethylpyrenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 methyl naphthyl)triphosphate, Adenosine-5'- (γ- (6-nitropyrenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 methoxynaphthyl) triphosphate, Adenosine-5'- (γ-6- (carboxysuccinimidyl fluorescein) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 nitro naphthyl) triphosphate. Adenosine-5'- (γ-6-carboxymethyl-2, 7-dichlorofluorescein) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 ethyl naphthyl) triphosphate, Adenosine-5'- (γ-4-phenyl)- (γ'-4 nitrophenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 butyl naphthyl)triphosphate, Adenosine-5'- (γ-4-phenyl)- (γ'-4 aminophenyl)triphosphate, Adenosine-5'- (γ-methyl) triphosphate, Adenosine-5'- (γ-3-aminopropyl) triphosphate, Guanosine-5'- (γ-methyl) triphosphate, Adenosine-5'- (γ-4-aminobutyl) triphosphate, Cytosine-5'- (γ-methyl) triphosphate Adenosine-5'- (γ-cyclohexyl) triphosphate, Thymidine-5'- (γ-methyl) triphosphate Adenosine-5'- (γ-2-carboxyethyl) triphosphate, Uracil-5'- (γ-methyl) triphosphate, Adenosine-5'- (γ-3-carboxypropyl)triphosphate, 3'-azido-3'-deoxythymidine-5'- (7-methyl) triphosphate, Adenosine-5'- (γ-4-carboxybutyl) triphosphate, 3'-azido-2',3'-dideoxythymidine-5'- (γ-methyl) triphosphate, Adenosine-5'- (γ-2-hydroxyethyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'-(γ-methyl)triphosphate, Adenosine-5'- (γ-3-hydroxypropyl) triphosphate, Adenosine-5'- (γ-ethyl) triphosphate, Adenosine-5'- (γ-propyl) triphosphate, Adenosine-5'- (γ-4-hydroxybutyl) triphosphate, Adenosine-5'- (γ-4-butyl) triphosphate, Adenosine-5'- (γ-2-nitroethyl) triphosphate, Adenosine-5'- (γ-hexyl) triphosphate, Adenosine-5'- (γ-3-nitropropyl) triphosphate, Adenosine-5'- (γ-isopropyl) triphosphate, Adenosine-5'- (γ-4-nitrobutyl) triphosphate, Adenosine-5'- (γ-tert-butyl) triphosphate ,Adenosine-5'- (γ-methyl)- (γ'-ethyl)triphosphate, Adenosine-5'- (γ-cyclohexyl) triphosphate, Adenosine-5'- (γ-2-aminoethyl)triphosphate, and Adenosine-5'- (γ-methyl)- (γ'-propyl) triphosphate.

27.(currently amended) The method of claim 13, wherein the tag ~~comprises a molecular tag~~ is covalently bonded to the modified nucleotide through a linker.



1 28.(currently amended) The method of claim 13, wherein the tag ~~comprises a molecular tag~~  
2 is covalently bonded to the modified nucleotide.

1 29.(previously presented) The method of claim 13, wherein the modified nucleotide comprises  
2 a  $\beta$  and/or  $\gamma$  phosphate modified nucleotide.

1 30.(previously presented) The method of claim 13, wherein the modified nucleotide comprises  
2 a  $\beta$  phosphate modified nucleotide.

1 31.(previously presented) The method of claim 13, wherein the modified nucleotide comprises  
2 a  $\gamma$  phosphate modified nucleotide.

1 32.(canceled) The method of claim 28, wherein the molecular tag comprises a fluorophore selected  
2 from the group consisting of 4-acetamido-4'-isothiocyanatostilbene-2,2'-disulfonic acid; acridine and  
3 derivatives: acridine, acridine isothiocyanate; 5- (2'-aminoethyl) aminonaphthalene-1-sulfonic acid  
4 (EDANS); 4-amino-3-vinylsulfonyl phenyl] naphthalimide-3,5 disulfonate; - (4-anilino-1-naphthyl)  
5 maleimide; anthranilamide; BODIPY; Brilliant Yellow; coumarin and derivatives: coumarin, 7-  
6 amino-4-methylcoumarin (AMC, Coumarin 120), 7-amino-4-trifluoromethylcoumarin (Coumarin  
7 151); cyanine dyes; cyanosine; 4', 6-diaminidino-2-phenylindole (DAPI); 5', 5''-dibromopyrogallol-  
8 sulfonaphthalein (Bromopyrogallol Red); 7-diethylamino-3- (4'-isothiocyanatophenyl)-4-  
9 methylcoumarin; diethylenetriamine pentaacetate; 4,4'-diisothiocyanatodihydro-stilbene-2,2'-  
10 disulfonic acid; 4,4' diisothiocyanatostilbene-2,2'-disulfonic acid; 5-dimethylamino naphthalene-1-  
11 sulfonyl chloride (DNS, dansylchloride); 4-dimethylaminophenylazophenyl-4'-isothiocyanate  
12 (DABITC); eosin and derivatives: eosin, eosin isothiocyanate, erythrosin and derivatives: erythrosin  
13 B, erythrosin, isothiocyanate; ethidium; fluorescein and derivatives: 5-carboxyfluorescein (FAM),  
14 5- (4, 6-dichlorotriazin-2-yl) aminofluorescein (DTAF), 2', 7'-dimethoxy-4',5'-dichloro-6-  
15 carboxyfluorescein (JOE), fluorescein, fluorescein isothiocyanate, QFITC, (XRITC); fluorescamine;  
16 IR144; IR1446; Malachite Green isothiocyanate; 4-methylumbelliferoneortho cresolphthalein;  
17 nitrotyrosine; pararosaniline; Phenol Red; B-phycoerythrin; o-phthalaldehyde; pyrene and  
18 derivatives: pyrene, pyrene butyrate, succinimidyl 1-pyrene; butyrate quantum dots; Reactive Red  
19 4 (Cibacron™ Brilliant Red 3B-A) rhodamine and derivatives: 6-carboxy-X-rhodamine (ROX),

6carboxyrhodamine (R6G), lissamine rhodamine B sulfonyl chloride rhodamine (Rhod), rhodamine B, rhodamine 123, rhodamine X isothiocyanate, sulforhodamine B, sulforhodamine 101, sulfonyl chloride derivative of sulforhodamine 101 (Texas Red); N, N, N', N'-tetramethyl-6-carboxyrhodamine (TAMRA); tetramethyl rhodamine; tetramethyl rhodamine isothiocyanate (TRITC); riboflavin; rosolic acid; terbium chelate derivatives; Cy 3; Cy 5; Cy 5.5; Cy 7; IRD 700; IRD 800; La Jolla Blue; phthalo cyanine; and naphthalo cyanine.

33.(canceled) The method of claim 27, wherein the linker is selected from the group consisting of alkyl groups having between 1 and 30 carbon atoms, aryl groups having between about 6 and about 40 carbon atoms, or alkaryl and aralkyl groups having between about 7 and about 40 carbon atoms, or mixture or combinations thereof, where the carbon atoms are replaced by one or more hetero atoms in the structure provided the structure represents a stable molecular system, where the hetero atoms selected from the group consisting of P, S, Si, N, and O.

34.(canceled) The method of claim 28, wherein the molecular tag is selected from the group consisting of 4-aminophenol, 6-aminonaphthol, 4-nitrophenol, 6-nitronaphthol, 4-methylphenol, 6-chloronaphthol, 4-methoxyphenol, 6-bromonaphthol, 4-chlorophenol, 6-iodonaphthol, 4-bromophenol, 4, 4'-dihydroxybiphenyl, 4-iodophenol, 8-hydroxyquinoline, 4-nitronaphthol, 3-hydroxypyridine, 4-aminonaphthol, umbelliferone, 4-methylnaphthol, resorufin, 4-methoxynaphthol, 8-hydroxypyrene, 4-chloronaphthol, 9-hydroxyanthracene, 4-bromonaphthol, 6-nitro-9-hydroxyanthracene, 4-iodonaphthol, 3-hydroxyflavone, 6-methylnaphthol, fluorescein, 6-methoxynaphthol, 3-hydroxybenzoflavone, 1-hydroxy-2-propyne, 1-hydroxy-4-pentyne, 1-hydroxy-3-butyne, 1-hydroxy-5-hexyne, Methanol, Ethanol, Propanol, Isopropanol, Butanol, Tert-butanol, Hexanol, Cyclohexanol, Heptanol, Octanol, Decanol, Undecanol, Dodecanol, 1-acetoxymethanol (CH<sub>3</sub>OCCH<sub>2</sub>-O-NTP), 2-acetoxyethanol, 3-acetoxypropanol, 4-acetoxybutanol, 5-acetoxypentanol, 6-acetoxyhexanol, 2-nitroethanol, 3-nitropropanol, 4-nitrobutanol, 5-nitropentanol, 5-nitrohexanol, 1-hydroxy-3-propene, 1-hydroxy-2-cyclohexene, 1-hydroxy-4-butene, 1-hydroxy-3-propaldehyde, 1-hydroxy-5-pentene, 1-hydroxy-4-butanaldehyde, 1-hydroxy-6-hexene, 1-hydroxy-3-Butanone, Phenol, 4-methyl-3-hydroxypyridine, 4-Carboxyphenol, 5-methoxy-3-hydroxypyridine, 4-Acetoxymethylphenol, 5-nitro-3-hydroxypyridine, 4-nitrophenol, 5-acetoxymethyl-3-hydroxypyridine, 4-methylphenol, 6-methyl-8-hydroxyquinoline, 4-methoxyphenol 6-methoxy-8-

hydroxyquinoline, 4-ethylphenol, 4-methyl-8-hydroxyquinoline, 4-butylphenol, 6-nitro-8-hydroxyquinoline, naphthol, 4-acetoxymethyl-8-hydroxyquinoline, 4 or 6 or 8 methylnaphthol pyrene, 4 or 6 or 8 methoxynaphthol, 6-methyl-8-hydroxypyrene, 4 or 6 or 8 nitronaphthol, 6-ethyl-8-hydroxypyrene, 4 or 6 or 8 ethylnaphthol, 6-nitro-8-hydroxypyrene, 4 or 6 or 8 butylnaphthol 6-(carboxysuccinimidylester) fluorescein, 4 or 6 or 8 acetoxymethylnaphthol, 6-carboxymethyl-2, 7-dichlorofluorescein, Methanol Cyclohexanol, 2-carboxy ethanol, 3-carboxypropanol, 4-carboxybutanol, 2-hydroxyethanol, 3-hydroxypropanol, 4-hydroxybutanol, 2-aminoethanol, 2-nitroethanol, 3-aminopropanol, 3-nitropropanol, 4-aminobutanol, and 4-nitrobutanol.

35.(previously presented) The method of claim 31, wherein the modified nucleotide is selected from the group consisting of Adenosine-5'- ( $\gamma$ -ANS) triphosphate, Guanosine-5'- ( $\gamma$ -ANS) triphosphate, Cytosine-5'- ( $\gamma$ -ANS) triphosphate, Thymidine-5'- ( $\gamma$ -ANS) triphosphate, Adenosine-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-iodonaphthyl), Guanosine-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, triphosphate Adenosine-5'- ( $\gamma$ -6-methylnaphthyl) triphosphate, Cytosine-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, Thymidine-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -6-methoxynaphthyl) triphosphate, Uracil-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, 3'-azido-3'-deoxythymidine-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -6-aminonaphthyl) triphosphate, 3'-azido-2', 3'-dideoxythymidine-5'- ( $\gamma$ -4- nitrophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -6-nitronaphthyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- ( $\gamma$ -4-nitrophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -6-chloronaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-aminophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -6-bromonaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-methylphenyl) triphosphate, Adenosine-5'- ( $\gamma$ -6-iodonaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-methoxyphenyl) triphosphate, Adenosine-5'- ( $\gamma$ -4'-hydroxybiphenyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-chlorophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -8-quinolyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-bromophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -3-pyridyl) triphosphate, Adenosine-5'- ( $\gamma$ -umbelliferone), Adenosine-5'- ( $\gamma$ -4-iodophenyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-nitronaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -resorufin) triphosphate, Adenosine-5'- ( $\gamma$ -pyrene) triphosphate, Adenosine-5'- ( $\gamma$ -4-aminonaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -anthracene) triphosphate, Adenosine-5'- ( $\gamma$ -6-nitroanthracene) triphosphate, Adenosine-5'- ( $\gamma$ -4-methylnaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -flavonyl) triphosphate, Adenosine-5'- ( $\gamma$ -4-methoxynaphthyl) triphosphate, Adenosine-5'- ( $\gamma$ -fluorescein) triphosphate, Adenosine-5'- ( $\gamma$ -benzoflavone) triphosphate, Adenosine-

23 5'- (γ-4-chloronaphthyl) triphosphate, Adenosine-5'- (γ- (4-nitrophenyl)- γ'- (4-aminophenyl)  
24 triphosphate, Adenosine-5'- (γ-4-bromonaphthyl) triphosphate, Adenosine-5'- (γ- (4-nitrophenyl)-  
25 γ'- (4-nitronaphthyl) triphosphate, Adenosine-5'- (γ-methyl) triphosphate, Adenosine-5'- (γ-  
26 acetoxypentyl)triphosphate, Guanosine-5'- (γ-methyl) triphosphate, Cytosine-5'- (γ-methyl)  
27 triphosphate, Adenosine-5'- (γ-acetoxymethyl)triphosphate (CH<sub>3</sub>OOCCH<sub>2</sub>-O-NTP), Thymidine-5'-  
28 (γ-methyl) triphosphate, Uracil-5'- (γ-methyl) triphosphate, Adenosine-5'- (γ-acetoxyethyl)  
29 triphosphate, 3'-azido-3'-deoxythymidine-5'- (γ-methyl)triphosphate, Adenosine-5'- (γ-  
30 acetoxybutyl)triphosphate, 3'-azido-2', 3'-dideoxythymidine-5'- (γ-methyl) triphosphate, Adenosine-  
31 5'- (γ, acetoxypentyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- (γ-methyl)  
32 triphosphate, Adenosine-5'- (γ- acetoxyhexyl) triphosphate, Adenosine-5'- (γ-ethyl) triphosphate,  
33 Adenosine-5'- (γ-2-nitroethyl) triphosphate, Adenosine-5'- (γ-propyl) triphosphate, Adenosine-5'-  
34 (γ-4-butyl) triphosphate, Adenosine-5'- (γ-3-nitropropyl) triphosphate, Adenosine-5'- (γ-hexyl)  
35 triphosphate, Adenosine-5'- (γ-octyl) triphosphate, Adenosine-5'- (γ-4-nitrobutyl)triphosphate,  
36 Adenosine-5'- (γ-decyl) triphosphate, Adenosine-5'- (γ-dodecyl) triphosphate, Adenosine-5'- (γ-5-  
37 nitropentyl)triphosphate, Adenosine-5'- (γ-isopropyl) triphosphate, Adenosine-5'- (γ-tert-butyl)  
38 triphosphate, Adenosine-5'- (γ-methyl)- (γ'-ethyl) triphosphate, Adenosine-5'- (γ-cyclohexyl)  
39 triphosphate, Adenosine-5'- (γ-methyl)- (γ'-propyl) triphosphate, Adenosine-5'- (γ-2-propenyl)  
40 triphosphate, Adenosine-5'- (γ-3-butenyl) triphosphate, Guanosine-5'- (γ-2-propenyl) triphosphate,  
41 Adenosine-5'- (γ-4-pentenyl) triphosphate, Cytosine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'-  
42 (γ-5-hexenyl) triphosphate, Thymidine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-  
43 cyclohexenyl) triphosphate, Uracil-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-3-  
44 propanaldehyde) triphosphate, 3'-azido-3'-deoxythymidine-5'- (γ-2-propenyl) triphosphate,  
45 Adenosine-5'- (γ-4-butanaldehyde) triphosphate, 3'-azido-2', 3'-dideoxythymidine-5'- (γ-2-propenyl)  
46 triphosphate, Adenosine-5'- (γ-3-butanone) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'-  
47 (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-2-propynyl) triphosphate, 3'-azido-2', 3'-  
48 dideoxythymidine-5'- (γ-2-propynyl) triphosphate, Guanosine-5'- (γ-2-propynyl) triphosphate,  
49 Cytosine-5'- (γ-2-propynyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- (γ-2-propynyl)  
50 triphosphate Thymidine 5'- (γ-2-propynyl) triphosphate, Uracil-5'- (γ-2-propynyl) triphosphate,  
51 Adenosine-5'- (γ-3-butyryl) triphosphate, 3'-azido-3'-deoxythymidine-5'- (γ-2-propynyl)  
52 triphosphate, Adenosine-5'- (γ-4-pentyryl) triphosphate, Adenosine-5'- (γ-5-pentyryl) triphosphate,  
53 Adenosine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 acetoxymethyl naphthyl)

triphosphate, Guanosine-5'- (γ-4-phenyl) triphosphate, Cytosine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (4-methylpyridyl)triphosphate, Thymidine-5'- (γ-4-phenyl) triphosphate, Uracil-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (5-methoxypyridyl)triphosphate, 3'-azido-3'-deoxythymidine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (5-nitropyridyl)triphosphate, 3'-azido-2',3'-dideoxythymidine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (5-acetoxymethylpyridyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (6-methyl-1-quinolyl) triphosphate, Adenosine-5'- (γ-4-carboxyphenyl) triphosphate, Adenosine-5'- (γ- (6-methoxy-1-quinolyl)triphosphate, Adenosine-5'- (γ- (4-acetoxymethyl) phenyl) triphosphate, Adenosine-5'- (γ- (4-methyl-1-quinolyl)triphosphate, Adenosine-5'- (γ-4-nitrophenyl) triphosphate, Adenosine-5'- (γ-4-methylphenyl)triphosphate, Adenosine-5'- (γ- (6-nitro-1-quinolyl) triphosphate, Adenosine-5'- (γ-4-methoxyphenyl) triphosphate, Adenosine-5'- (γ- (4-acetoxymethylpyrenyl) triphosphate, Adenosine-5'- (γ-4-ethylphenyl) triphosphate, Adenosine-5'- (γ- (6-methylpyrenyl) triphosphate, Adenosine-5'- (γ-4-butylphenyl) triphosphate, Adenosine 5'- (γ-naphthyl) triphosphate, Adenosine-5'- (γ- (6-ethylpyrenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 methyl naphthyl)triphosphate, Adenosine-5'- (γ- (6-nitropyrenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 methoxynaphthyl) triphosphate, Adenosine-5'- (γ-6- (carboxysuccinimidyl fluorescein) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 nitro naphthyl) triphosphate. Adenosine-5'- (γ-6-carboxymethyl-2, 7-dichlorofluorescein) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 ethyl naphthyl) triphosphate, Adenosine-5'- (γ-4-phenyl)- (γ'-4 nitrophenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 butyl naphthyl)triphosphate, Adenosine-5'- (γ-4-phenyl)- (γ'-4 aminophenyl)triphosphate, Adenosine-5'- (γ-methyl) triphosphate, Adenosine-5'- (γ-3-aminopropyl) triphosphate, Guanosine-5'- (γ-methyl) triphosphate, Adenosine-5'- (γ-4-aminobutyl) triphosphate, Cytosine-5'- (γ-methyl) triphosphate Adenosine-5'- (γ-cyclohexyl) triphosphate, Thymidine-5'- (γ-methyl) triphosphate Adenosine-5'- (γ-2-carboxyethyl) triphosphate, Uracil-5'- (γ-methyl) triphosphate, Adenosine-5'- (γ-3-carboxypropyl)triphosphate, 3'-azido-3'-deoxythymidine-5'- (7-methyl) triphosphate, Adenosine-5'- (γ-4-carboxybutyl) triphosphate, 3'-azido-2',3'-dideoxythymidine-5'- (γ-methyl) triphosphate, Adenosine-5'- (γ-2-hydroxyethyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- (γ-methyl)triphosphate, Adenosine-5'- (γ-3-hydroxypropyl) triphosphate, Adenosine-5'- (γ-ethyl) triphosphate, Adenosine-5'- (γ-propyl) triphosphate, Adenosine-5'- (γ-4-hydroxybutyl) triphosphate, Adenosine-5'- (γ-4-butyl) triphosphate, Adenosine-5'- (γ-2-nitroethyl) triphosphate, Adenosine-5'- (γ-hexyl) triphosphate, Adenosine-5'- (γ-

85 3-nitropropyl) triphosphate, Adenosine-5'- (γ-isopropyl) triphosphate, Adenosine-5'- (γ-4-nitrobutyl)  
86 triphosphate, Adenosine-5'- (γ-tert-butyl) triphosphate ,Adenosine-5'- (γ-methyl)- (γ'-  
87 ethyl)triphosphate, Adenosine-5'- (γ-cyclohexyl) triphosphate, Adenosine-5'- (γ-2-  
88 aminoethyl)triphosphate, and Adenosine-5'- (γ-methyl)- (γ'-propyl) triphosphate.

1 36.(previously presented) The method of claim 7, wherein the polymerizing agent is selected  
2 from the group consisting of naturally occurring or synthetic polymerases and reverse transcriptases.

1 37.(previously presented) The method of claim 13, wherein the polymerizing agent is selected  
2 from the group consisting of naturally occurring or synthetic polymerases and reverse transcriptases.

1 38.(currently amended) The kit of claim 15, wherein the tag ~~comprises a molecular tag~~ is  
2 covalently bonded to the modified nucleotide through a linker.

1 39.(currently amended) The kit of claim 15, wherein the tag ~~comprises a molecular tag~~ is  
2 covalently bonded to the modified nucleotide.

1 40.(previously presented) The kit of claim 15, wherein the modified nucleotide comprises a β  
2 and/or γ phosphate modified nucleotide.

1 41.(previously presented) The kit of claim 15, wherein the modified nucleotide comprises a β  
2 phosphate modified nucleotide.

1 42.(previously presented) The kit of claim 15, wherein the modified nucleotide comprises a γ  
2 phosphate modified nucleotide.

1 43.(previously presented) The kit of claim 39, wherein the molecular tag comprises a  
2 fluorophore selected from the group consisting of 4-acetamido-4'isothiocyantostilbene-  
3 2,2'disulfonic acid; acridine and derivatives: acridine, acridine isothiocyanate; 5- (2'-aminoethyl)  
4 aminonaphthalene-1-sulfonic acid (EDANS); 4-amino-3-vinylsulfonyl phenyl] naphthalimide-3,5  
5 disulfonate; - (4-anilino-1naphthyl) maleimide; anthranilamide; BODIPY; Brilliant Yellow;

coumarin and derivatives: coumarin, 7-amino-4-methylcoumarin (AMC, Coumarin 120), 7-amino-4-trifluoromethylcoumarin (Coumarin 151); cyanine dyes; cyanosine; 4', 6-diaminidino-2-phenylindole (DAPI); 5', 5''-dibromopyrogallol-sulfonaphthalein (Bromopyrogallol Red); 7-diethylamino-3-(4'-isothiocyanatophenyl)-4-methylcoumarin; diethylenetriamine pentaacetate; 4,4'-diisothiocyanatodihydro-stilbene-2,2'-disulfonic acid; 4,4' diisothiocyanatostilbene-2,2'-disulfonic acid; 5-dimethylamino naphthalene-1-sulfonyl chloride (DNS, dansylchloride); 4-dimethylaminophenylazophenyl-4'-isothiocyanate (DABITC); eosin and derivatives: eosin, eosin isothiocyanate, erythrosin and derivatives: erythrosin B, erythrosin, isothiocyanate; ethidium; fluorescein and derivatives: 5-carboxyfluorescein (FAM), 5-(4, 6-dichlorotriazin-2-yl)aminofluorescein (DTAF), 2', 7'-dimethoxy-4',5'-dichloro-6-carboxyfluorescein (JOE), fluorescein, fluorescein isothiocyanate, QFITC, (XRITC); fluorescamine; IR144; IR1446; Malachite Green isothiocyanate; 4-methylumbelliferoneortho cresolphthalein; nitrotyrosine; pararosaniline; Phenol Red; B-phycoerythrin; o-phthalaldehyde; pyrene and derivatives: pyrene, pyrene butyrate, succinimidyl 1-pyrene; butyrate quantum dots; Reactive Red 4 (Cibacron™ Brilliant Red 3B-A) rhodamine and derivatives: 6-carboxy-X-rhodamine (ROX), 6-carboxyrhodamine (R6G), lissamine rhodamine B sulfonyl chloride rhodamine (Rhod), rhodamine B, rhodamine 123, rhodamine X isothiocyanate, sulforhodamine B, sulforhodamine 101, sulfonyl chloride derivative of sulforhodamine 101 (Texas Red); N, N, N', N'-tetramethyl-6-carboxyrhodamine (TAMRA); tetramethyl rhodamine; tetramethyl rhodamine isothiocyanate (TRITC); riboflavin; rosolic acid; terbium chelate derivatives; Cy 3; Cy 5; Cy 5.5; Cy 7; IRD 700; IRD 800; La Jolla Blue; phthalocyanine; and naphthalocyanine.

**44.(previously presented)** The kit of claim 39, wherein the molecular tag is selected from the group consisting of alkyl groups having between 1 and 30 carbon atoms, aryl groups having between about 6 and about 40 carbon atoms, or alkaryl and aralkyl groups having between about 7 and about 40 carbon atoms, or mixture or combinations thereof, where the carbon atoms are replaced by one or more hetero atoms in the structure provided the structure represents a stable molecular system, where the hetero atoms selected from the group consisting of P, S, Si, N, and O.

**45.(previously presented)** The kit of claim 39, wherein the molecular tag is selected from the group consisting of 4-aminophenol, 6-aminonaphthol, 4-nitrophenol, 6-nitronaphthol, 4-

3 methylphenol, 6-chloronaphthol, 4-methoxyphenol, 6-bromonaphthol, 4-chlorophenol, 6-  
4 iodonaphthol, 4-bromophenol, 4, 4'-dihydroxybiphenyl, 4-iodophenol, 8-hydroxyquinoline, 4-  
5 nitronaphthol, 3-hydroxypyridine, 4-aminonaphthol, umbelliferone, 4-methylnaphthol, resorufin, 4-  
6 methoxynaphthol, 8-hydroxypyrene, 4-chloronaphthol, 9-hydroxyanthracene, 4-bromonaphthol, 6-  
7 nitro-9-hydroxyanthracene, 4-iodonaphthol, 3-hydroxyflavone, 6-methylnaphthol, fluorescein, 6-  
8 methoxynaphthol, 3-hydroxybenzoflavone, 1-hydroxy-2-propyne, 1-hydroxy-4-pentyne, 1-hydroxy-  
9 3-butyne, 1-hydroxy-5-hexyne, Methanol, Ethanol, Propanol, Isopropanol, Butanol, Tert-butanol,  
10 Hexanol, Cyclohexanol, Heptanol, Octanol, Decanol, Undecanol, Dodecanol, 1-acetoxymethanol  
11 (CH<sub>3</sub>OCCH<sub>2</sub>-O-NTP), 2-acetoxyethanol, 3-acetoxypropanol, 4-acetoxybutanol, 5-acetoxypentanol,  
12 6-acetoxyhexanol, 2-nitroethanol, 3-nitropropanol, 4-nitrobutanol, 5-nitropentanol, 5-nitrohexanol,  
13 1-hydroxy-3-propene, 1-hydroxy-2-cyclohexene, 1-hydroxy-4-butene, 1-hydroxy-3-propaldehyde,  
14 1-hydroxy-5-pentene, 1-hydroxy-4-butanaldehyde, 1-hydroxy-6-hexene, 1-hydroxy-3-Butanone,  
15 Phenol, 4-methyl-3-hydroxypyridine, 4-Carboxyphenol, 5-methoxy-3-hydroxypyridine, 4-  
16 Acetoxymethylphenol, 5-nitro-3-hydroxypyridine, 4-nitrophenol, 5-acetoxymethyl-3-  
17 hydroxypyridine, 4-methylphenol, 6-methyl-8-hydroxyquinoline, 4-methoxyphenol 6-methoxy-8-  
18 hydroxyquinoline, 4-ethylphenol, 4-methyl-8-hydroxyquinoline, 4-butylphenol, 6-nitro-8-  
19 hydroxyquinoline, naphthol, 4-acetoxymethyl-8-hydroxyquinoline, 4 or 6 or 8 methylnaphthol  
20 pyrene, 4 or 6 or 8 methoxynaphthol, 6-methyl-8-hydroxypyrene, 4 or 6 or 8 nitronaphthol, 6-ethyl-  
21 8-hydroxypyrene, 4 or 6 or 8 ethylnaphthol, 6-nitro-8-hydroxypyrene, 4 or 6 or 8 butylnaphthol 6-  
22 (carboxysuccinimidylester) fluorescein, 4 or 6 or 8 acetoxymethylnaphthol, 6-carboxymethyl-2, 7-  
23 dichlorofluorescein, Methanol Cyclohexanol, 2-carboxy ethanol, 3-carboxypropanol, 4-  
24 carboxybutanol, 2-hydroxyethanol, 3-hydroxypropanol, 4-hydroxybutanol, 2-aminoethanol, 2-  
25 nitroethanol, 3-aminopropanol, 3-nitropropanol, 4-aminobutanol, and 4-nitrobutanol.

1 46.(previously presented) The kit of claim 42, wherein the modified nucleotide is selected from  
2 the group consisting of Adenosine-5'- (γ-ANS) triphosphate, Guanosine-5'- (γ-ANS) triphosphate,  
3 Cytosine-5'- (γ-ANS) triphosphate, Thymidine-5'- (γ-ANS) triphosphate, Adenosine-5'- (γ-4-  
4 nitrophenyl) triphosphate, Adenosine-5'- (γ-4-iodonaphthyl), Guanosine-5'- (γ-4-nitrophenyl)  
5 triphosphate, triphosphate Adenosine-5'- (γ-6-methylnaphthyl) triphosphate, Cytosine-5'- (γ-4-  
6 nitrophenyl) triphosphate, Thymidine-5'- (γ-4-nitrophenyl) triphosphate, Adenosine-5'- (γ-6-  
7 methoxynaphthyl) triphosphate, Uracil-5'- (γ-4-nitrophenyl) triphosphate, 3'-azido-3'-



8 deoxythymidine-5'-( $\gamma$ -4-nitrophenyl)triphosphate, Adenosine-5'-( $\gamma$ -6-aminonaphthyl) triphosphate,  
 9 3'-azido-2', 3'-dideoxythymidine-5'-( $\gamma$ -4-nitrophenyl)triphosphate, Adenosine-5'-( $\gamma$ -6-  
 10 nitronaphthyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'-( $\gamma$ -4-  
 11 nitrophenyl)triphosphate, Adenosine-5'-( $\gamma$ -6-chloronaphthyl) triphosphate, Adenosine-5'-( $\gamma$ -4-  
 12 aminophenyl) triphosphate, Adenosine-5'-( $\gamma$ -6-bromonaphthyl) triphosphate, Adenosine-5'-( $\gamma$ -4-  
 13 methylphenyl) triphosphate, Adenosine-5'-( $\gamma$ -6-iodonaphthyl) triphosphate, Adenosine-5'-( $\gamma$ -4-  
 14 methoxyphenyl) triphosphate, Adenosine-5'-( $\gamma$ -4'-hydroxybiphenyl) triphosphate, Adenosine-5'-( $\gamma$ -  
 15 4-chlorophenyl) triphosphate, Adenosine-5'-( $\gamma$ -8-quinolyl) triphosphate, Adenosine-5'-( $\gamma$ -4-  
 16 bromophenyl) triphosphate, Adenosine-5'-( $\gamma$ -3-pyridyl) triphosphate, Adenosine-5'-( $\gamma$ -  
 17 umbelliferone), Adenosine-5'-( $\gamma$ -4-iodophenyl) triphosphate, Adenosine-5'-( $\gamma$ -4-nitronaphthyl)  
 18 triphosphate, Adenosine-5'-( $\gamma$ -resorufin) triphosphate, Adenosine-5'-( $\gamma$ -pyrene) triphosphate,  
 19 Adenosine-5'-( $\gamma$ -4-aminonaphthyl) triphosphate, Adenosine-5'-( $\gamma$ -anthracene) triphosphate,  
 20 Adenosine-5'-( $\gamma$ -6-nitroanthracene) triphosphate, Adenosine-5'-( $\gamma$ -4-methylnaphthyl) triphosphate,  
 21 Adenosine-5'-( $\gamma$ -flavonyl) triphosphate, Adenosine-5'-( $\gamma$ -4-methoxynaphthyl) triphosphate,  
 22 Adenosine-5'-( $\gamma$ -fluorescein) triphosphate, Adenosine-5'-( $\gamma$ -benzoflavone) triphosphate, Adenosine-  
 23 5'-( $\gamma$ -4-chloronaphthyl) triphosphate, Adenosine-5'-( $\gamma$ -(4-nitrophenyl)- $\gamma'$ -(4-aminophenyl)  
 24 triphosphate, Adenosine-5'-( $\gamma$ -4-bromonaphthyl) triphosphate, Adenosine-5'-( $\gamma$ -(4-nitrophenyl)-  
 25  $\gamma'$ -(4-nitronaphthyl) triphosphate, Adenosine-5'-( $\gamma$ -methyl) triphosphate, Adenosine-5'-( $\gamma$ -  
 26 acetoxypentyl)triphosphate, Guanosine-5'-( $\gamma$ -methyl) triphosphate, Cytosine-5'-( $\gamma$ -methyl)  
 27 triphosphate, Adenosine-5'-( $\gamma$ -acetoxymethyl)triphosphate (CH<sub>3</sub>COCH<sub>2</sub>-O-NTP), Thymidine-5'-  
 28 ( $\gamma$ -methyl) triphosphate, Uracil-5'-( $\gamma$ -methyl) triphosphate, Adenosine-5'-( $\gamma$ -acetoxylethyl)  
 29 triphosphate, 3'-azido-3'-deoxythymidine-5'-( $\gamma$ -methyl)triphosphate, Adenosine-5'-( $\gamma$ -  
 30 acetoxypentyl)triphosphate, 3'-azido-2', 3'-dideoxythymidine-5'-( $\gamma$ -methyl) triphosphate, Adenosine-  
 31 5'-( $\gamma$ , acetoxypentyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'-( $\gamma$ -methyl)  
 32 triphosphate, Adenosine-5'-( $\gamma$ -acetoxylhexyl) triphosphate, Adenosine-5'-( $\gamma$ -ethyl) triphosphate,  
 33 Adenosine-5'-( $\gamma$ -2-nitroethyl) triphosphate, Adenosine-5'-( $\gamma$ -propyl) triphosphate, Adenosine-5'-  
 34 ( $\gamma$ -4-butyl) triphosphate, Adenosine-5'-( $\gamma$ -3-nitropropyl) triphosphate, Adenosine-5'-( $\gamma$ -hexyl)  
 35 triphosphate, Adenosine-5'-( $\gamma$ -octyl) triphosphate, Adenosine-5'-( $\gamma$ -4-nitrobutyl)triphosphate,  
 36 Adenosine-5'-( $\gamma$ -decyl) triphosphate, Adenosine-5'-( $\gamma$ -dodecyl) triphosphate, Adenosine-5'-( $\gamma$ -5-  
 37 nitropentyl)triphosphate, Adenosine-5'-( $\gamma$ -isopropyl) triphosphate, Adenosine-5'-( $\gamma$ -tert-butyl)  
 38 triphosphate, Adenosine-5'-( $\gamma$ -methyl)-( $\gamma'$ -ethyl) triphosphate, Adenosine-5'-( $\gamma$ -cyclohexyl)

39 triphosphate, Adenosine-5'- (γ-methyl)- (γ'-propyl) triphosphate, Adenosine-5'- (γ-2-propenyl)  
40 triphosphate, Adenosine-5'- (γ-3-butenyl) triphosphate, Guanosine-5'- (γ-2-propenyl) triphosphate,  
41 Adenosine-5'- (γ-4-pentenyl) triphosphate, Cytosine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'-  
42 (γ-5-hexenyl) triphosphate, Thymidine-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-  
43 cyclohexenyl) triphosphate, Uracil-5'- (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-3-  
44 propanaldehyde) triphosphate, 3'-azido-3'-deoxythymidine-5'- (γ-2-propenyl) triphosphate,  
45 Adenosine-5'- (γ-4-butanaldehyde) triphosphate, 3'-azido-2',3'-dideoxythymidine-5'- (γ-2-propenyl)  
46 triphosphate, Adenosine-5'- (γ-3-butanone) triphosphate, 2',3'-didehydro-2',3'-dideoxythymidine-5'-  
47 (γ-2-propenyl) triphosphate, Adenosine-5'- (γ-2-propynyl) triphosphate, 3'-azido-2', 3'-  
48 dideoxythymidine-5'- (γ-2-propynyl) triphosphate, Guanosine-5'- (γ-2-propynyl) triphosphate,  
49 Cytosine-5'- (γ-2-propynyl) triphosphate, 2',3'-didehydro-2',3'-dideoxythymidine-5'- (γ-2-propynyl)  
50 triphosphate Thymidine 5'- (γ-2-propynyl) triphosphate, Uracil-5'- (γ-2-propynyl) triphosphate,  
51 Adenosine-5'- (γ-3-butyryl) triphosphate, 3'-azido-3'-deoxythymidine-5'- (γ-2-propynyl)  
52 triphosphate, Adenosine-5'- (γ-4-pentyryl) triphosphate, Adenosine-5'- (γ-5-pentyryl) triphosphate,  
53 Adenosine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 acetoxymethyl naphthyl)  
54 triphosphate, Guanosine-5'- (γ-4-phenyl) triphosphate, Cytosine-5'- (γ-4-phenyl) triphosphate,  
55 Adenosine-5'- (γ- (4-methylpyridyl) triphosphate, Thymidine-5'- (γ-4-phenyl) triphosphate, Uracil-5'-  
56 (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (5-methoxypyridyl) triphosphate, 3'-azido-3'-  
57 deoxythymidine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (5-nitropyridyl) triphosphate, 3'-  
58 azido-2',3'-dideoxythymidine-5'- (γ-4-phenyl) triphosphate, Adenosine-5'- (γ- (5-  
59 acetoxymethylpyridyl) triphosphate, 2', 3'-didehydro-2', 3'-dideoxythymidine-5'- (γ-4-phenyl)  
60 triphosphate, Adenosine-5'- (γ- (6-methyl-1-quinolyl) triphosphate, Adenosine-5'- (γ-4-  
61 carboxyphenyl) triphosphate, Adenosine-5'- (γ- (6-methoxy-1-quinolyl) triphosphate, Adenosine-5'-  
62 (γ- (4-acetoxymethyl) phenyl) triphosphate, Adenosine-5'- (γ- (4-methyl-1-quinolyl) triphosphate,  
63 Adenosine-5'- (γ-4-nitrophenyl) triphosphate, Adenosine-5'- (γ-4-methylphenyl) triphosphate,  
64 Adenosine-5'- (γ- (6-nitro-1-quinolyl) triphosphate, Adenosine-5'- (γ-4-methoxyphenyl)  
65 triphosphate, Adenosine-5'- (γ- (4-acetoxymethylpyrenyl) triphosphate, Adenosine-5'- (γ-4-  
66 ethylphenyl) triphosphate, Adenosine-5'- (γ- (6-methylpyrenyl) triphosphate, Adenosine-5'- (γ-4-  
67 butylphenyl) triphosphate, Adenosine 5'- (γ-naphthyl) triphosphate, Adenosine-5'- (γ- (6-  
68 ethylpyrenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 methyl naphthyl) triphosphate, Adenosine-  
69 5'- (γ- (6-nitropyrenyl) triphosphate, Adenosine-5'- (γ- (4 or 6 or 8 methoxynaphthyl) triphosphate,

Adenosine-5'-( $\gamma$ -6-(carboxysuccinimidyl fluorescein) triphosphate, Adenosine-5'-( $\gamma$ -(4 or 6 or 8 nitro naphthyl) triphosphate. Adenosine-5'-( $\gamma$ -6-carboxymethyl-2, 7-dichlorofluorescein) triphosphate, Adenosine-5'-( $\gamma$ -(4 or 6 or 8 ethyl naphthyl) triphosphate, Adenosine-5'-( $\gamma$ -4-phenyl)-( $\gamma$ '-4 nitrophenyl) triphosphate, Adenosine-5'-( $\gamma$ -(4 or 6 or 8 butyl naphthyl)triphosphate, Adenosine-5'-( $\gamma$ -4-phenyl)-( $\gamma$ '-4 aminophenyl)triphosphate, Adenosine-5'-( $\gamma$ -methyl) triphosphate, Adenosine-5'-( $\gamma$ -3-aminopropyl) triphosphate, Guanosine-5'-( $\gamma$ -methyl) triphosphate, Adenosine-5'-( $\gamma$ -4-aminobutyl) triphosphate, Cytosine-5'-( $\gamma$ -methyl) triphosphate Adenosine-5'-( $\gamma$ -cyclohexyl) triphosphate, Thymidine-5'-( $\gamma$ -methyl) triphosphate Adenosine-5'-( $\gamma$ -2-carboxyethyl) triphosphate, Uracil-5'-( $\gamma$ -methyl) triphosphate, Adenosine-5'-( $\gamma$ -3-carboxypropyl)triphosphate, 3'-azido-3'-deoxythymidine-5'-(7-methyl) triphosphate, Adenosine-5'-( $\gamma$ -4-carboxybutyl) triphosphate, 3'-azido-2',3'-dideoxythymidine-5'-( $\gamma$ -methyl) triphosphate, Adenosine-5'-( $\gamma$ -2-hydroxyethyl) triphosphate, 2',3'-didehydro-2',3'-dideoxythymidine-5'-( $\gamma$ -methyl)triphosphate, Adenosine-5'-( $\gamma$ -3-hydroxypropyl) triphosphate, Adenosine-5'-( $\gamma$ -ethyl) triphosphate, Adenosine-5'-( $\gamma$ -propyl) triphosphate, Adenosine-5'-( $\gamma$ -4-hydroxybutyl) triphosphate, Adenosine-5'-( $\gamma$ -4-butyl) triphosphate, Adenosine-5'-( $\gamma$ -2-nitroethyl) triphosphate, Adenosine-5'-( $\gamma$ -hexyl) triphosphate, Adenosine-5'-( $\gamma$ -3-nitropropyl) triphosphate, Adenosine-5'-( $\gamma$ -isopropyl) triphosphate, Adenosine-5'-( $\gamma$ -4-nitrobutyl) triphosphate, Adenosine-5'-( $\gamma$ -tert-butyl) triphosphate ,Adenosine-5'-( $\gamma$ -methyl)-( $\gamma$ '-ethyl)triphosphate, Adenosine-5'-( $\gamma$ -cyclohexyl) triphosphate, Adenosine-5'-( $\gamma$ -2-aminoethyl)triphosphate, and Adenosine-5'-( $\gamma$ -methyl)-( $\gamma$ '-propyl) triphosphate.

47.(previously presented) The kit of claim 15, wherein the polymerizing agent is selected from the group consisting of naturally occurring or synthetic polymerases and reverse transcriptases.